



# A system overview of the **E**lectronic **S**urveillance **S**ystem for the **E**arly **N**otification of **C**ommunity-based **E**pidemics

Presented at the 2004 Scientific Conference  
on Chemical & Biological Defense Research  
15 November 2004

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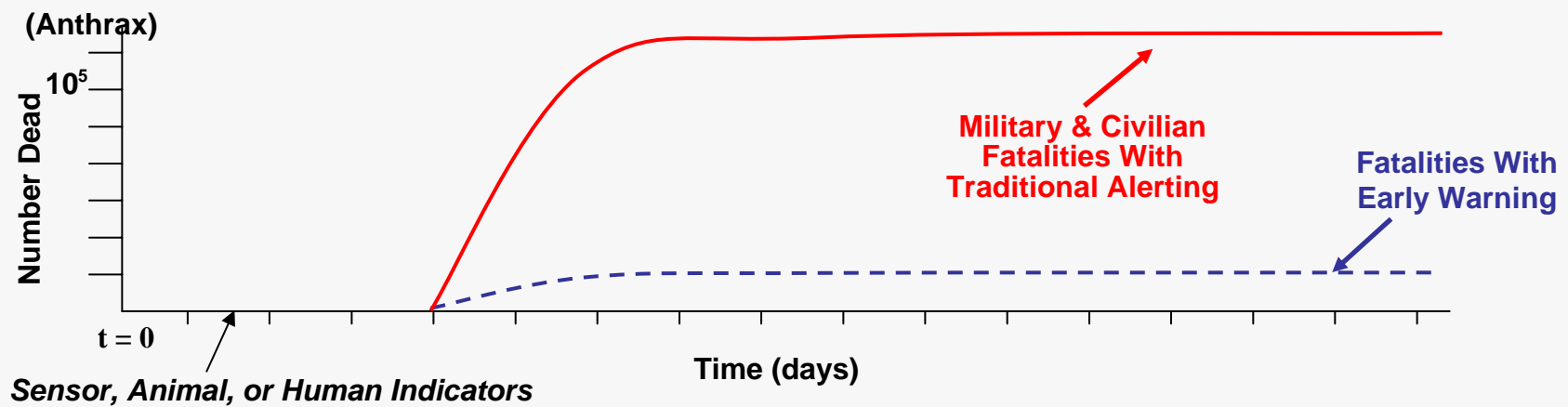
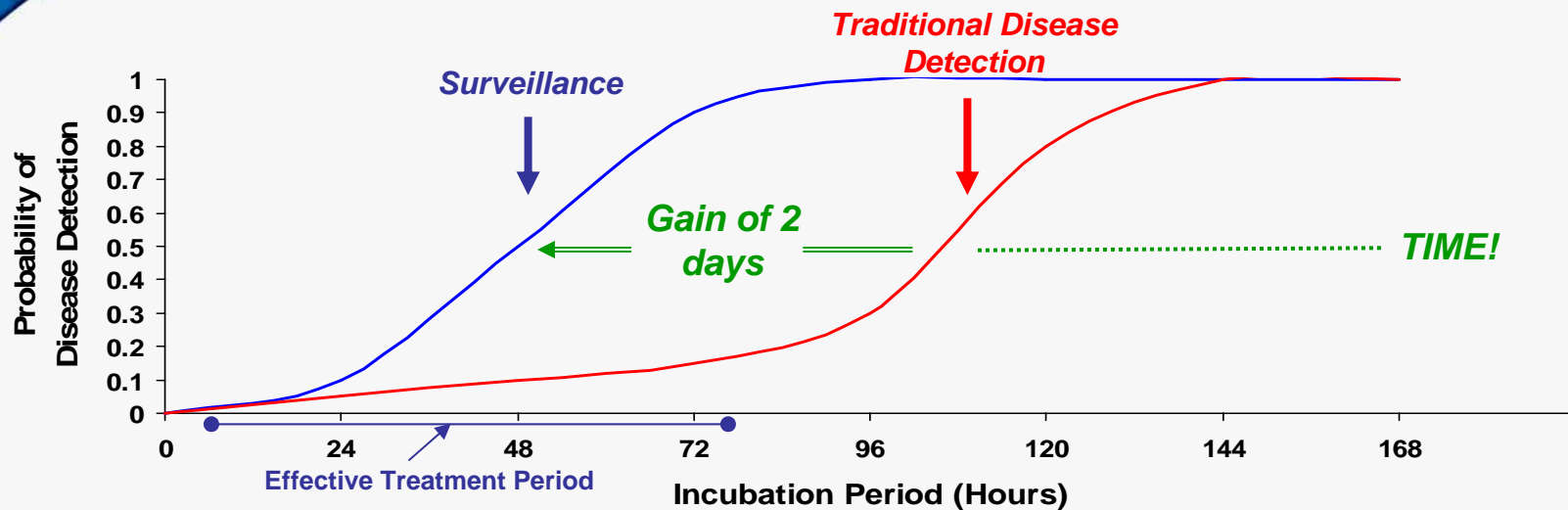
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Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE <b>15 NOV 2004</b>		2. REPORT TYPE <b>N/A</b>		3. DATES COVERED <b>-</b>	
4. TITLE AND SUBTITLE <b>A system overview of the Electronic Surveillance System for the Early Notification of Community-based Epidemics</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>Johns Hopkins University Applied Physics Laboratory</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release, distribution unlimited</b>					
13. SUPPLEMENTARY NOTES <b>See also ADM001849, 2004 Scientific Conference on Chemical and Biological Defense Research. Held in Hunt Valley, Maryland on 15-17 November 2004 . , The original document contains color images.</b>					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>UU</b>	18. NUMBER OF PAGES <b>25</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			



# Justification for Enhanced Surveillance (Anthrax)





# Definition of Surveillance

- **Epidemiologic Surveillance**
  - **Ongoing and systematic collection, analysis, and interpretation of health data**
  - **Used to determine need for public health action and to assess the effectiveness of programs**



# Syndromic Surveillance Definition

**Syndromic Surveillance is the collection and analysis of pre-diagnosis information that lead to an estimation of the health status of the community**

Syndromic surveillance uses health care indicators such as:

- Emergency Room Chief Complaint
- International Classification of Disease Billing Codes
- Requests for Specific Laboratory Tests
- Over the Counter Medications Sales

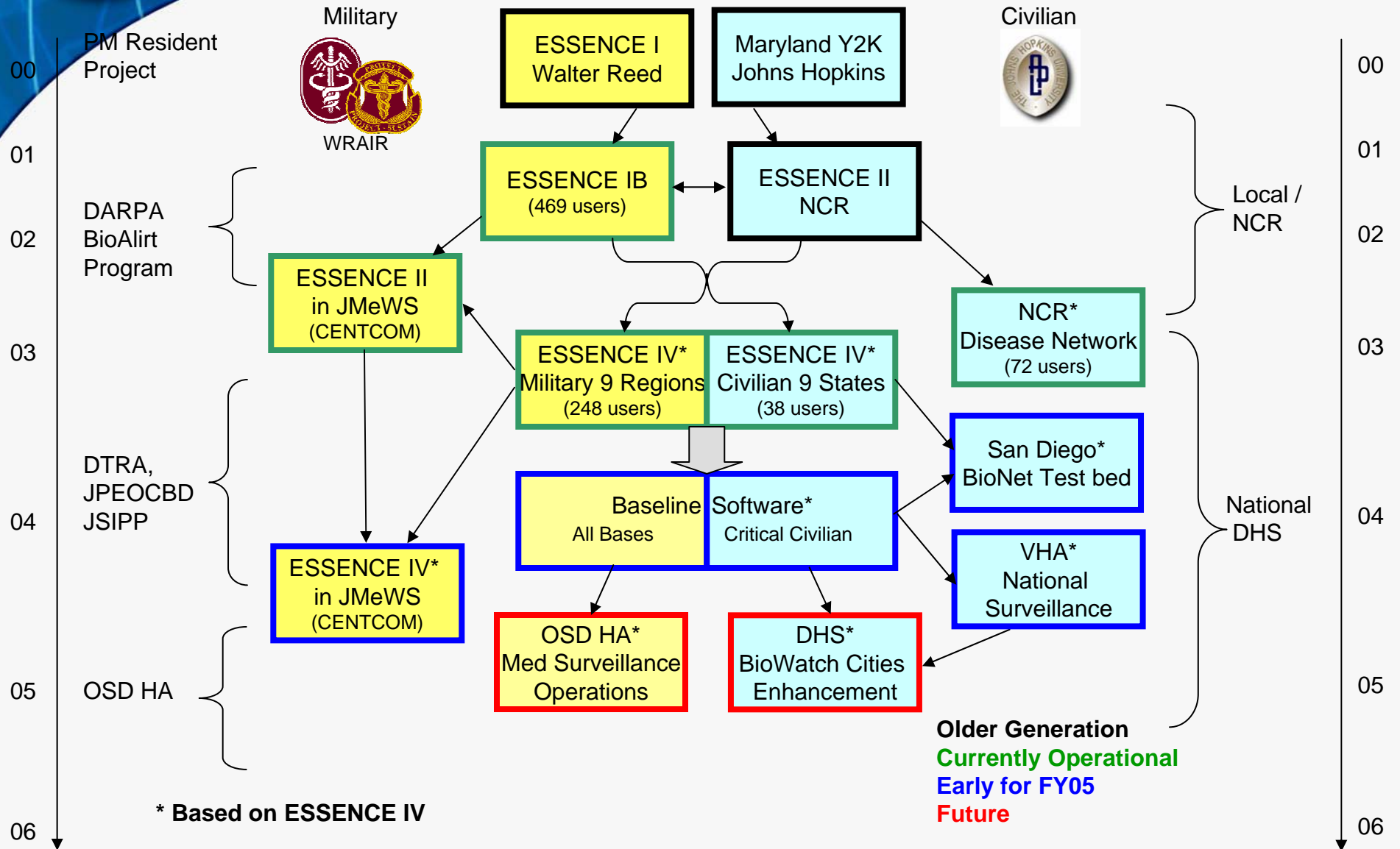
Grouped into specific syndromic categories such as:

- Respiratory
- Gastrointestinal
- Neurological
- Dermatological
- Fever
- etc.



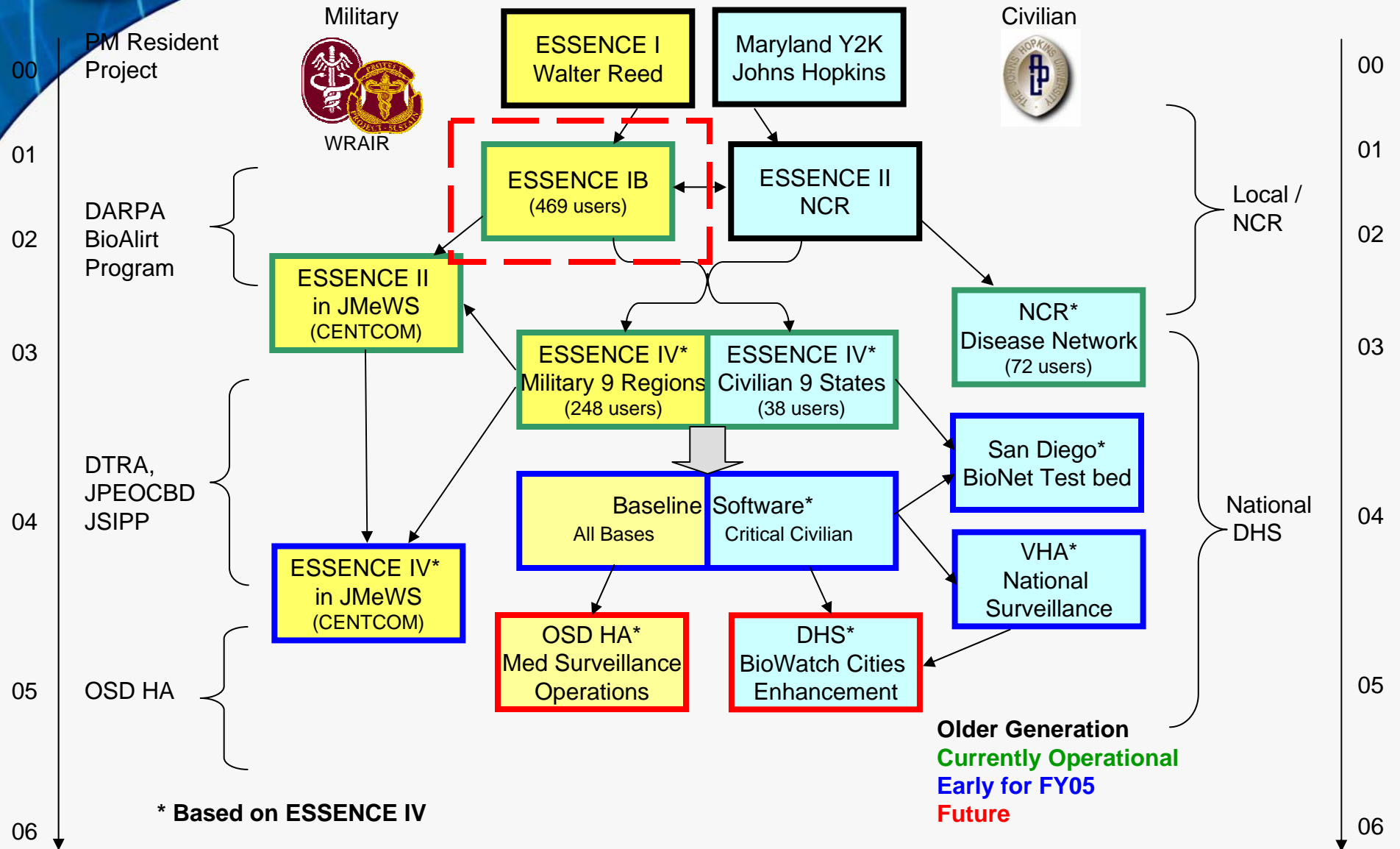


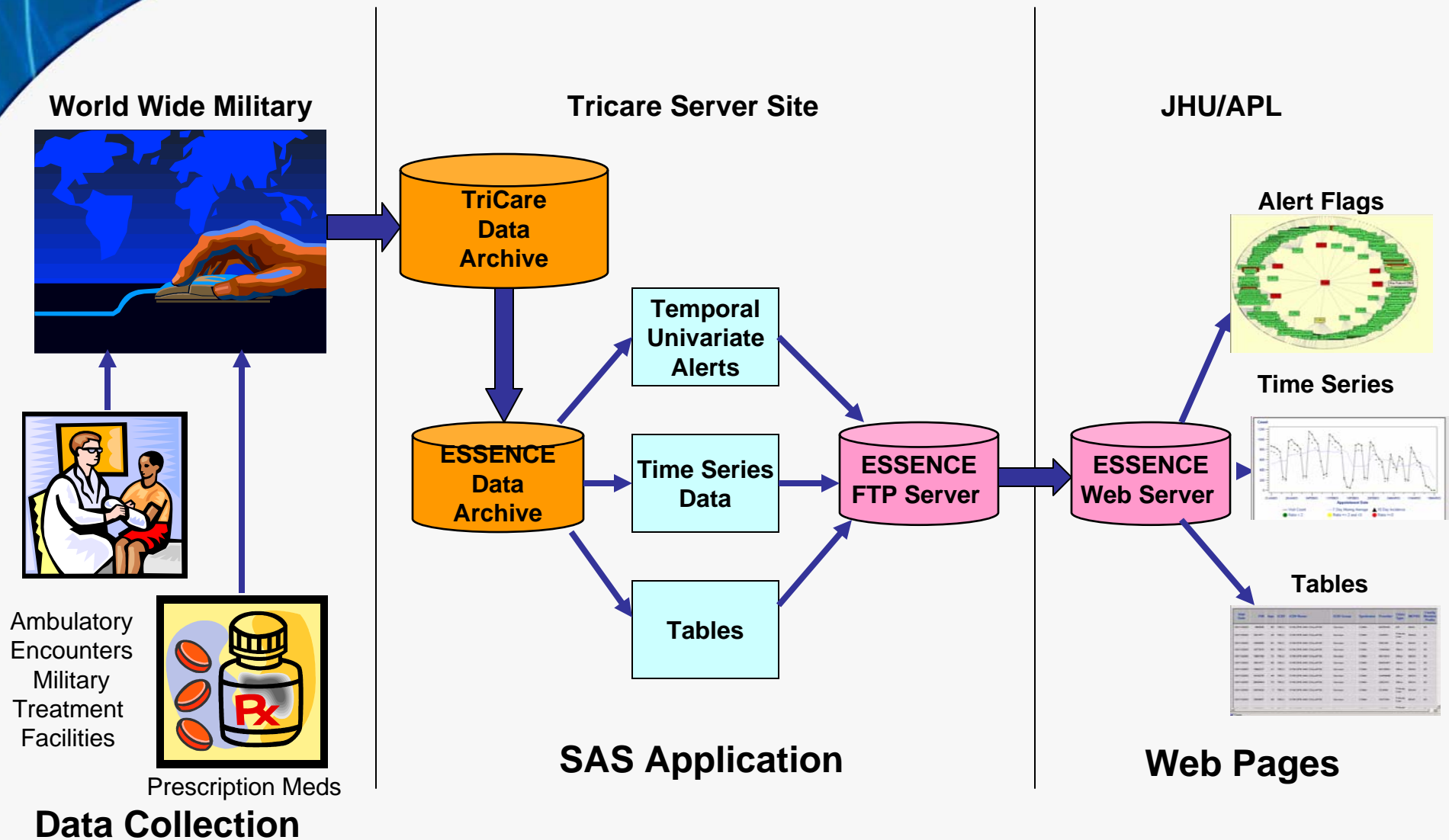
# Evolution of ESSENCE





# Evolution of ESSENCE

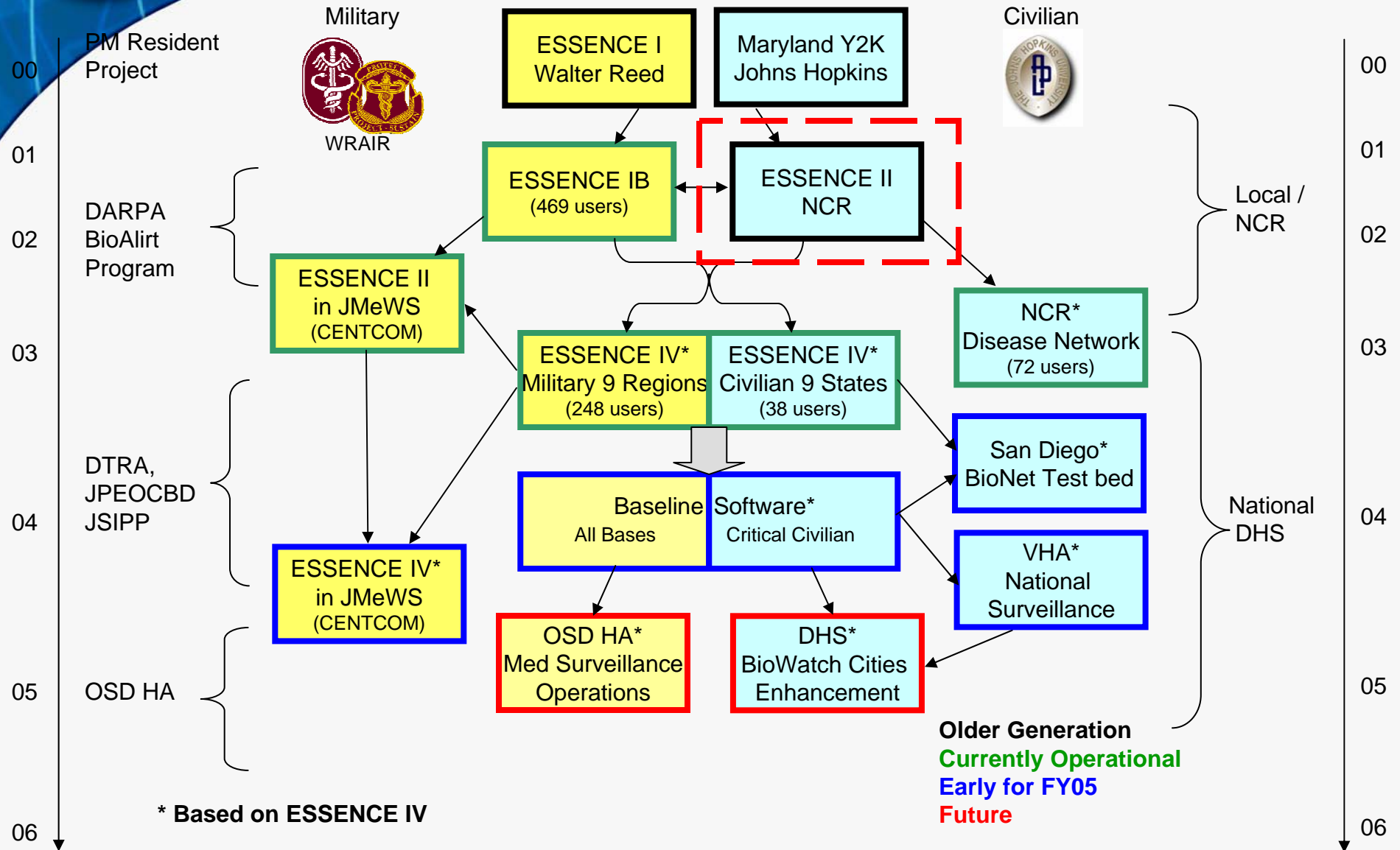








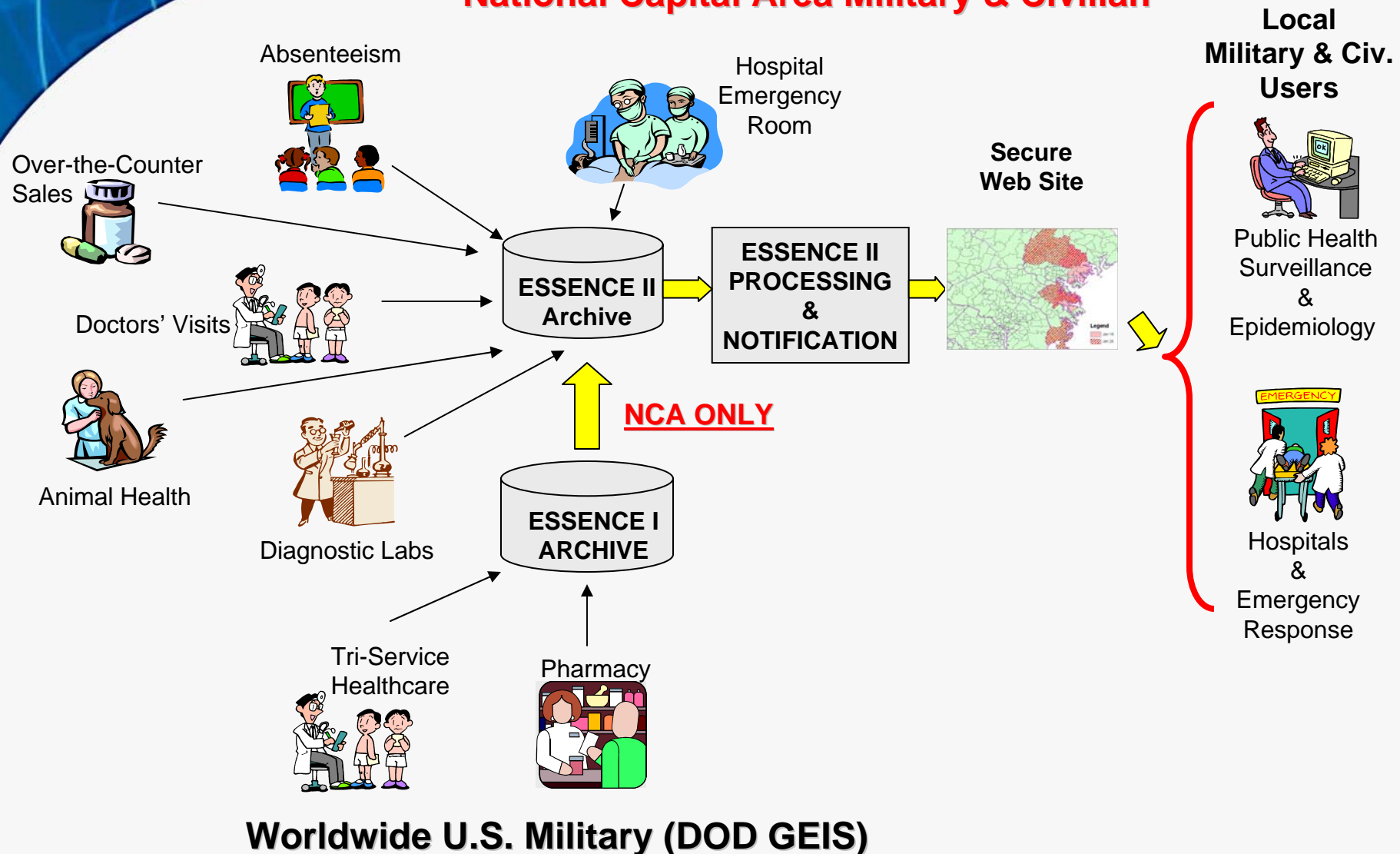
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# Integration of Military & Civilian Indicators for ESSENCE II

## National Capital Area Military & Civilian





# Major ESSENCE II-IV Components

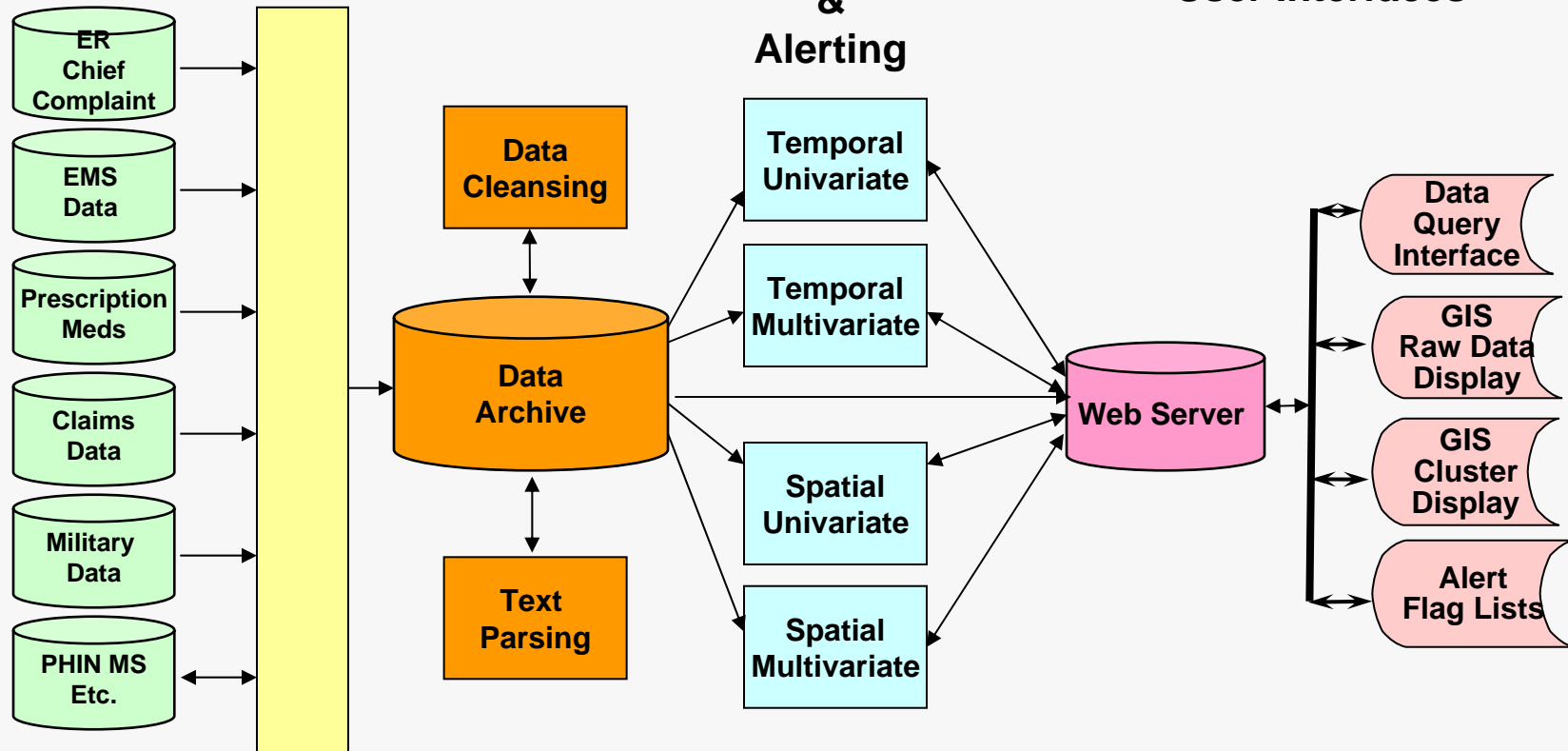
Health Condition  
Indicator Data

Comms

Archiving

Analysis  
&  
Alerting

User Interfaces



Real-time HL-7  
PHIN MS  
XML, etc.

Secure FTP  
VPN, etc.





# Synthetic Data Used to Show Features of Alert List

[History of ESSENCE](#) [Syndrome Definitions](#) [Detector Algorithms](#) [Data Dictionary](#) [Help](#)



HOME



Alert List



Query



Map  
Portal



Message  
Board

## ESSENCE IV - Texas Alert List

### Region/Syndrome Based Temporal Alerts

[\[Region/Syndrome\]](#) [\[Region/ICD9Group\]](#) [\[Hospital/Syndrome\]](#) [\[Spatial\]](#)

[Reset 3-Level Sorting](#)

#### Region/Syndrome Based Temporal Alerts

Date	Data Source	Region	Age	Sex	Syndrome	Detector	Level	Count	Ex
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	All	All	Rash	JHUAPL-Regression/EWMA	3.768	7	3.9
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	All	All	Neurological	JHUAPL-Regression/EWMA	3.188	9	4.6
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	All	All	Neurological	JHUAPL-Regression/EWMA	4.045	5	2.5
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	65+	All	Neurological	JHUAPL-Regression/EWMA	3.233	6	2
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	65+	All	Respiratory	JHUAPL-Regression/EWMA	2.097	28	16.
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	18-64	All	Rash	JHUAPL-Regression/EWMA	2.435	3	1.6
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	0-4	All	Rash	JHUAPL-Regression/EWMA	2.357	3	1.1
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	18-64	All	Neurological	JHUAPL-Regression/EWMA	2.788	6	1.8
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	0-4	All	Rash	JHUAPL-Regression/EWMA	2.654	4	1
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	All	M	Rash	JHUAPL-Regression/EWMA	2.398	2	0.6
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	65+	M	GastroIntestinal	JHUAPL-Regression/EWMA	2.387	4	1.6
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	18-64	M	Respiratory	JHUAPL-Regression/EWMA	9.865	27	10.
14Apr04	Emergency Room Data by Patient Location	HEALTHREGION7	0-4	M	UnspecifiedInfection	JHUAPL-Regression/EWMA	3.063	11	5.4

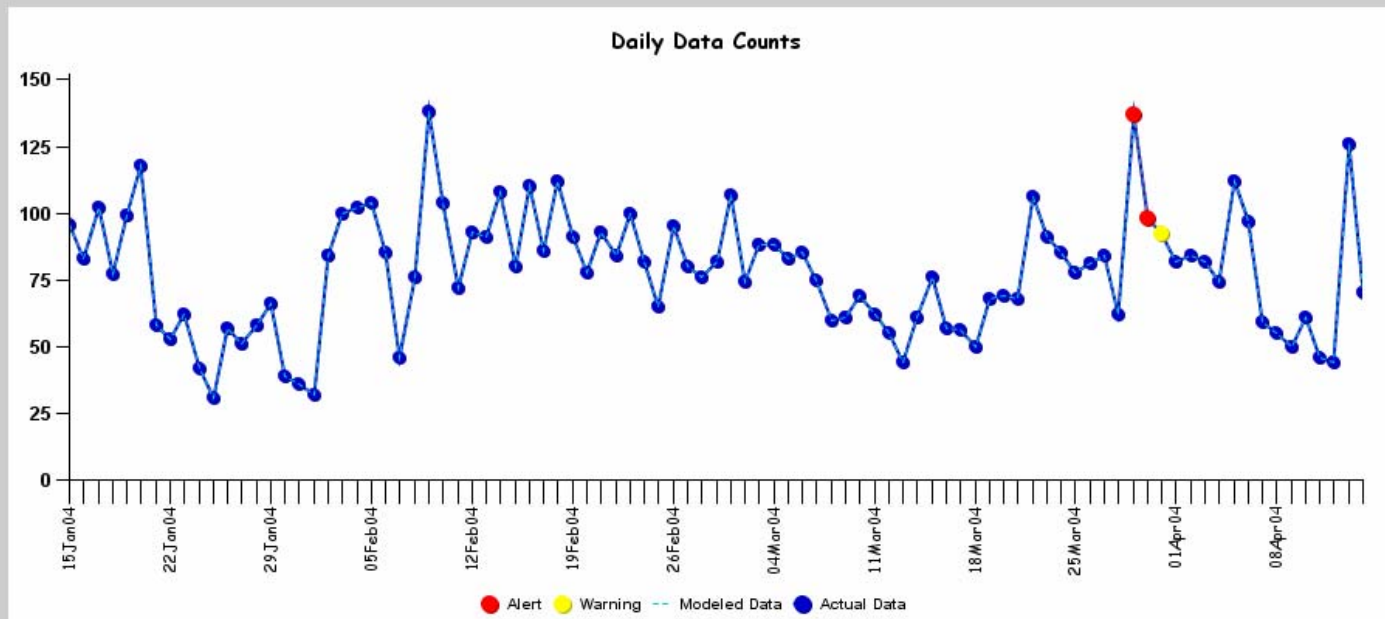


# Synthetic Syndrome Time Series

Region	HEALTHREGION7
Medical Grouping System	ESSENCE Syndrome
ESSENCE Syndrome	Respiratory
Age Group	18-64
Sex	Male
Detector	JHUAPL-Regression/EWMA
Start Date	15Jan04
End Date	14Apr04

☒ Configuration Options

☐ Graph



[ [Enhanced Graph \(requires java 1.4.x plug-in\)](#) | [Basic Graph](#) ]





# Analysis Options

15 Jan 04 22 Jan 04 29 Jan 04 05 Feb 04 12 Feb 04 19 Feb 04 26 Feb 04 04 Mar 04 11 Mar 04 18 Mar 04 25 Mar 04 01 Apr 04 08 Apr 04

● Alert ● Warning - - Modeled Data ● Actual Data

[ [Enhanced Graph \(requires java 1.4.x plug-in\)](#) | [Basic Graph](#) ]

☐ Popup Options

[ [Time Series](#) | [Data Details](#) | [Map View](#) | [Summary View](#) ]

Show Weekly Time Series Viewer:

Show 14-Day Incidence Graph:

Select detectors to compare:

JHUAPL-Regression/EWMA  
JHUAPL-EWMA  
JHUAPL-Regression

Select Datasources to compare:

Emergency Room Data by Patient Location

☐ Data Table

Data Table

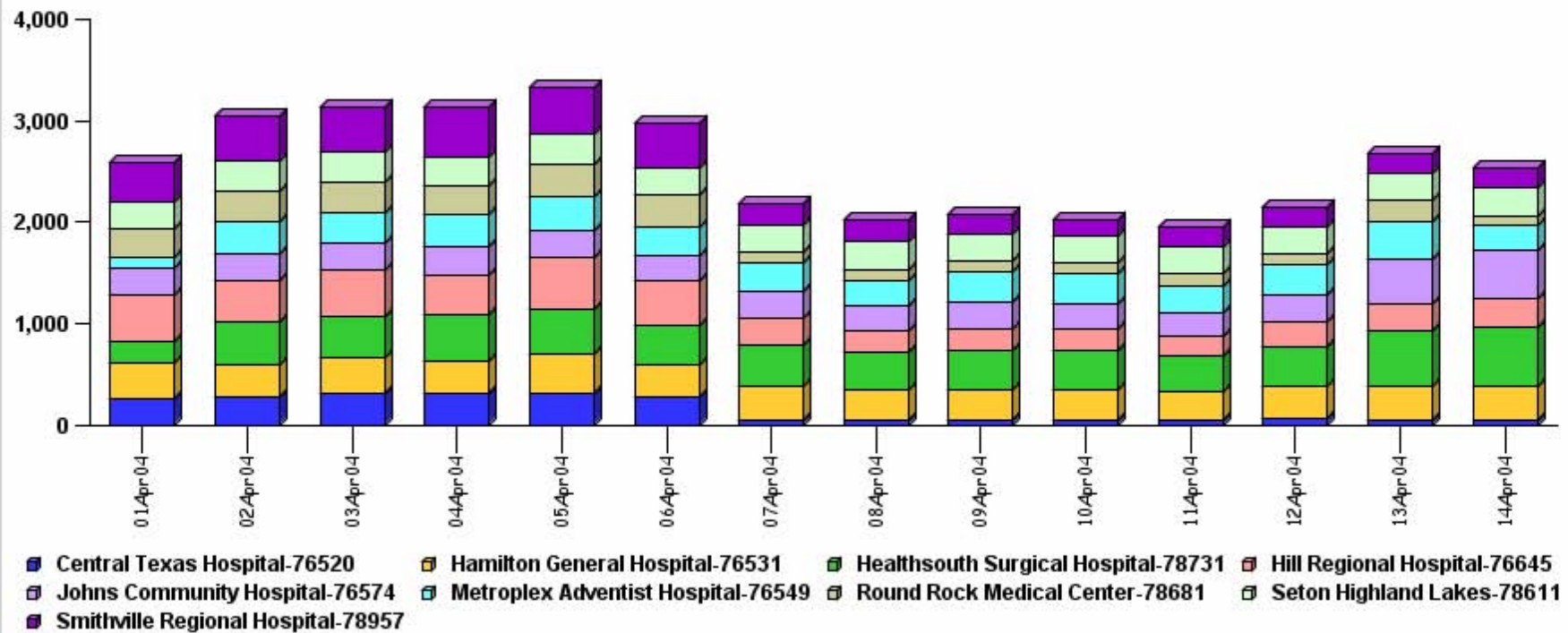
Date	Modeled Data	Actual Data	Detection	Data Link	Map Link
14Apr04	70	70	0	<a href="#">Data Details</a>	<a href="#">Map View</a>
13Apr04	126	126	0.317	<a href="#">Data Details</a>	<a href="#">Map View</a>
12Apr04	44	44	0	<a href="#">Data Details</a>	<a href="#">Map View</a>
11Apr04	46	46	0	<a href="#">Data Details</a>	<a href="#">Map View</a>
10Apr04	61	61	0	<a href="#">Data Details</a>	<a href="#">Map View</a>
09Apr04	50	50	0	<a href="#">Data Details</a>	<a href="#">Map View</a>
08Apr04	55	55	0	<a href="#">Data Details</a>	<a href="#">Map View</a>
07Apr04	59	59	0	<a href="#">Data Details</a>	<a href="#">Map View</a>
06Apr04	97	97	0.036	<a href="#">Data Details</a>	<a href="#">Map View</a>



# Stacked Graph Example

ESSENCE IV - Texas Time Series - Microsoft Internet Explorer

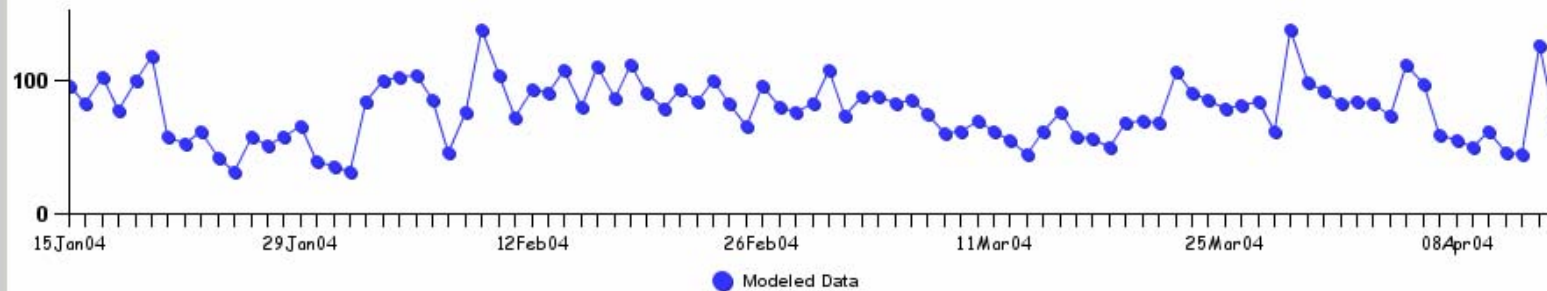
Stacked Graph of Time Series Data by HospitalGrouping



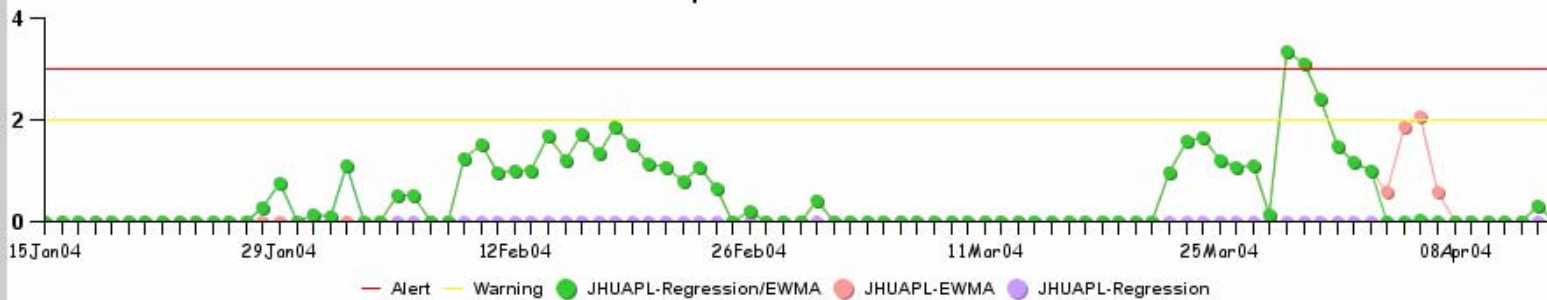


# Detector Comparisons

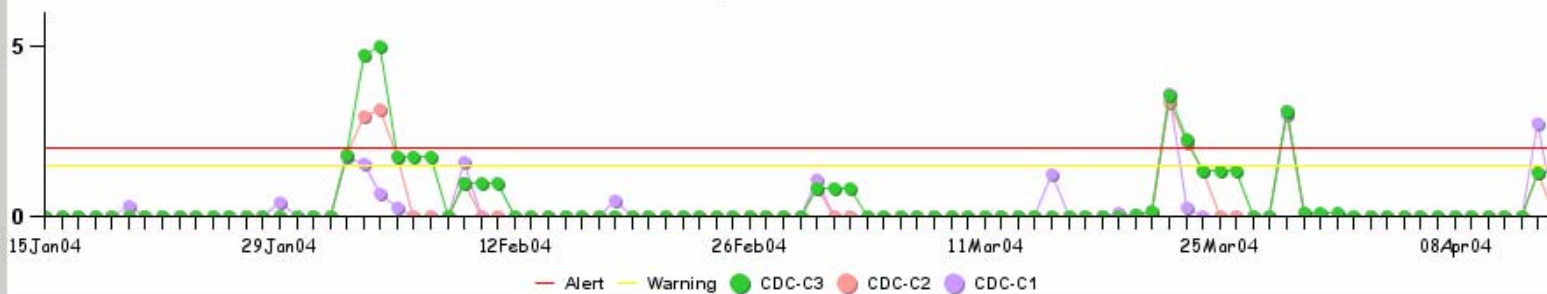
Detector Comparison -- Modeled Data



Detector Comparison -- Non-CDC Detectors



Detector Comparison -- CDC Detectors

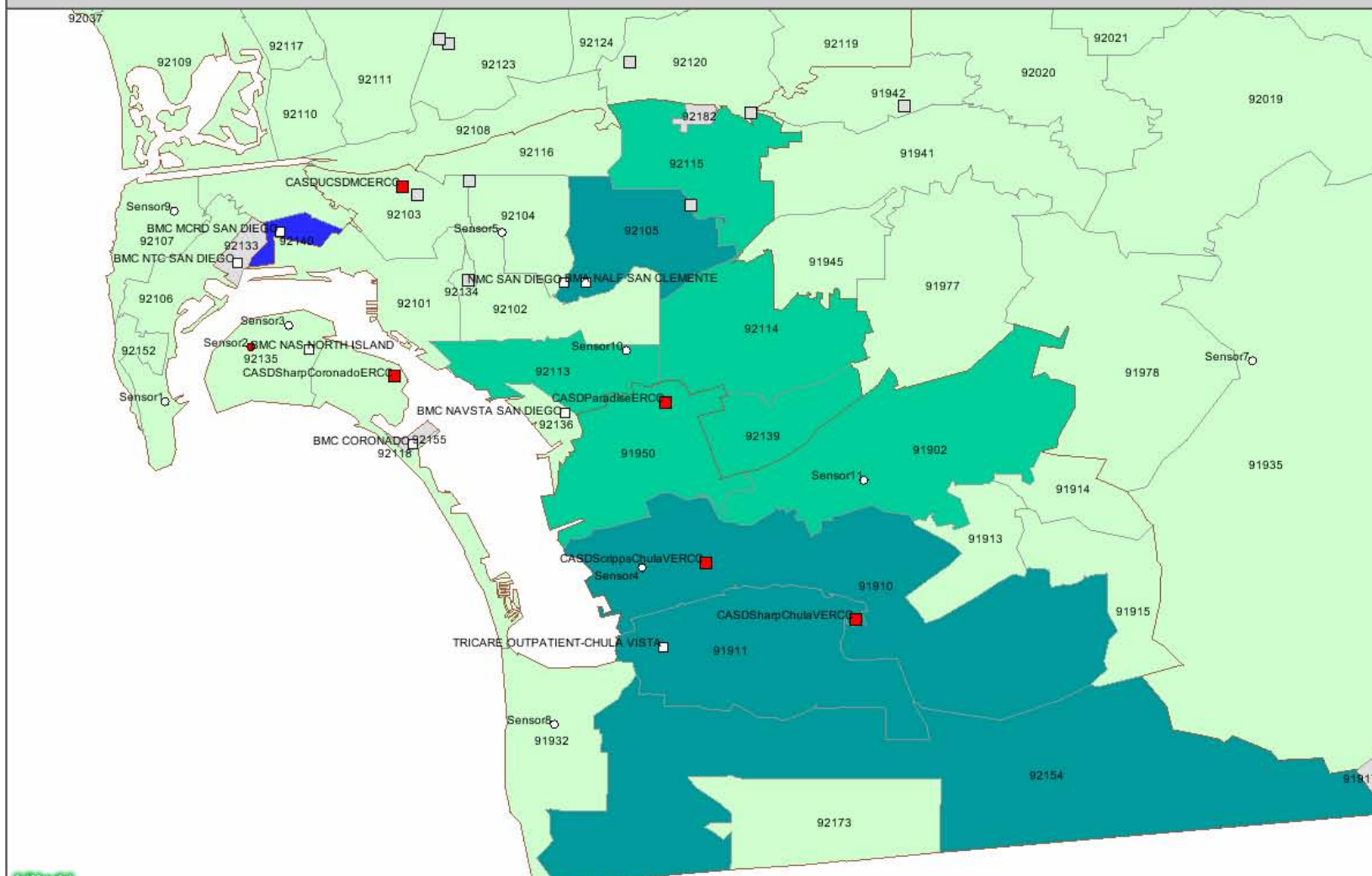




# ESSENCE IV - San Diego Simulation, California : Data Sources Map

Toggles: Navigation: Date Range: Other: Help:

Current Tool: [Select Rectangle](#)



**LAYERS**

- ☒ All Layers
- ☒ Base Layers
- ☒ ER By Hospital
  - ☐ [Visible|Label|Active|Name] hosp
  - ☐ [Visible|Label|Active|Name] hosp%
  - ☐ [Visible|Label|Active|Name] hosp\_rtd
- ☒ ER By Zipcode
  - ☐ [Visible|Label|Active|Name] er
  - ☐ [Visible|Label|Active|Name] er\_rtd
- ☒ Civilian Office Visits
  - ☐ [Visible|Label|Active|Name] civ02
  - ☐ [Visible|Label|Active|Name] civ02\_rtd
- ☒ Military Outpatient Visits
  - ☐ [Visible|Label|Active|Name] mil01
  - ☐ [Visible|Label|Active|Name] mil01\_rtd
- ☒ Civilian and Military
- ☒ EMS
- ☒ OTC Sales
- ☒ Prescription Medication
- ☒ PDS
- ☒ School Absences
- ☒ Sensor
  - ☐ [Visible|Label|Active|Name] Sensors
- ☒ Plume Model
  - ☐ [Visible|Label|Active|Name] Plume

☒ Auto Refresh

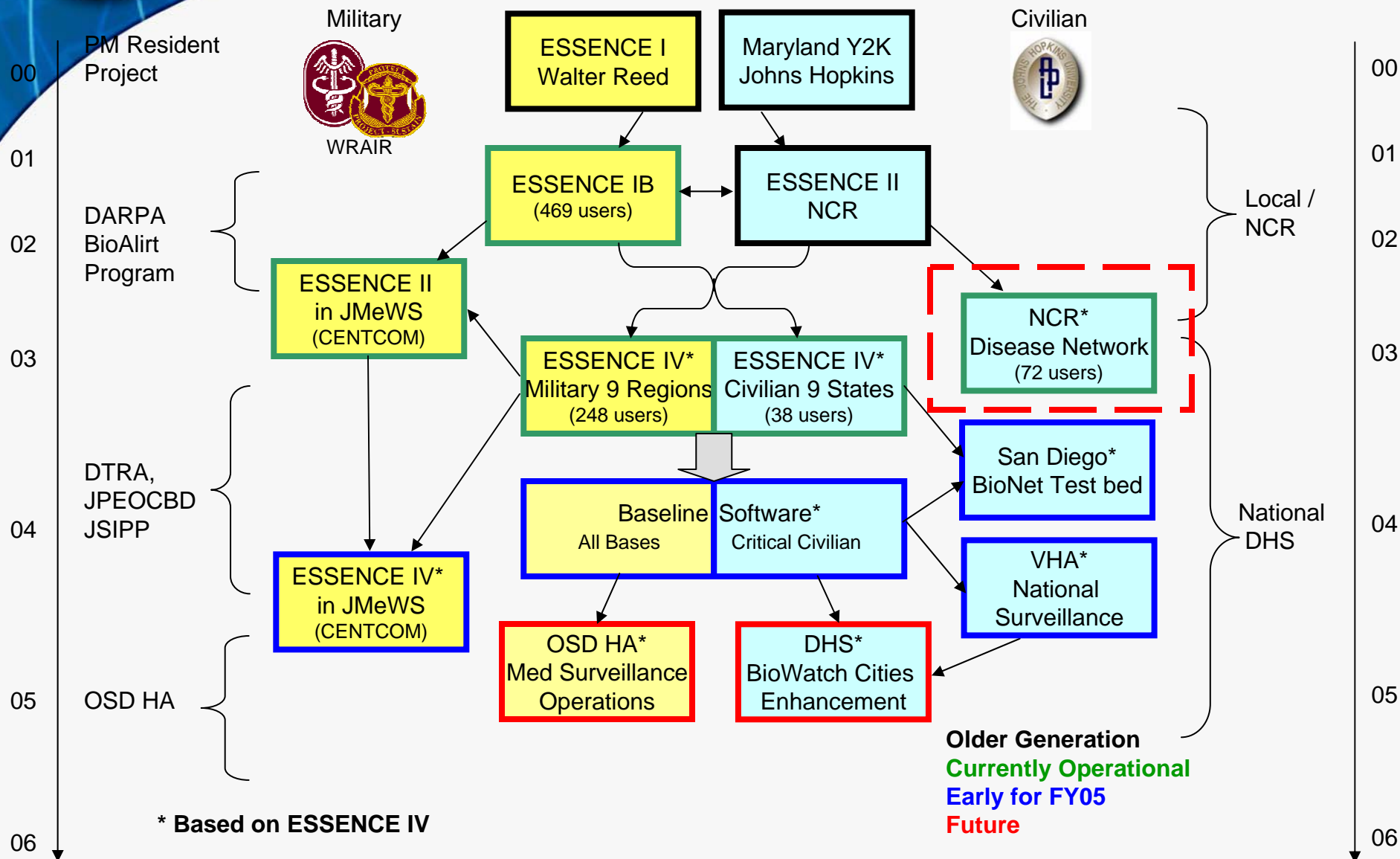
- ☒ Alert
- ☐ Sensors:Labels
- ☐ MTFs
- ☐ MTFs:Labels
- ☐ Regions
- ☐ er
- ☐ N/A
- ☐ 0-15
- ☐ 16-30
- ☐ 31-45
- ☐ 46+
- ☐ Zips:Labels
- ☐ Zips

04Nov04  
 San Diego Tabletop, Synthetic Data  
Nov 4th, Respiratory Distribution

Layer Name	er	Data Column Name	Value
Data Source	Emergency Room Data by Patient Location	Geography System	Zipcode
Medical Grouping System	ESSENCE Syndrome	ESSENCE Syndrome	Resp
Age Group	All	Sex	All
Detector	JHUAPL-Regression/EWMA	Start Date	4Nov04



# Evolution of ESSENCE

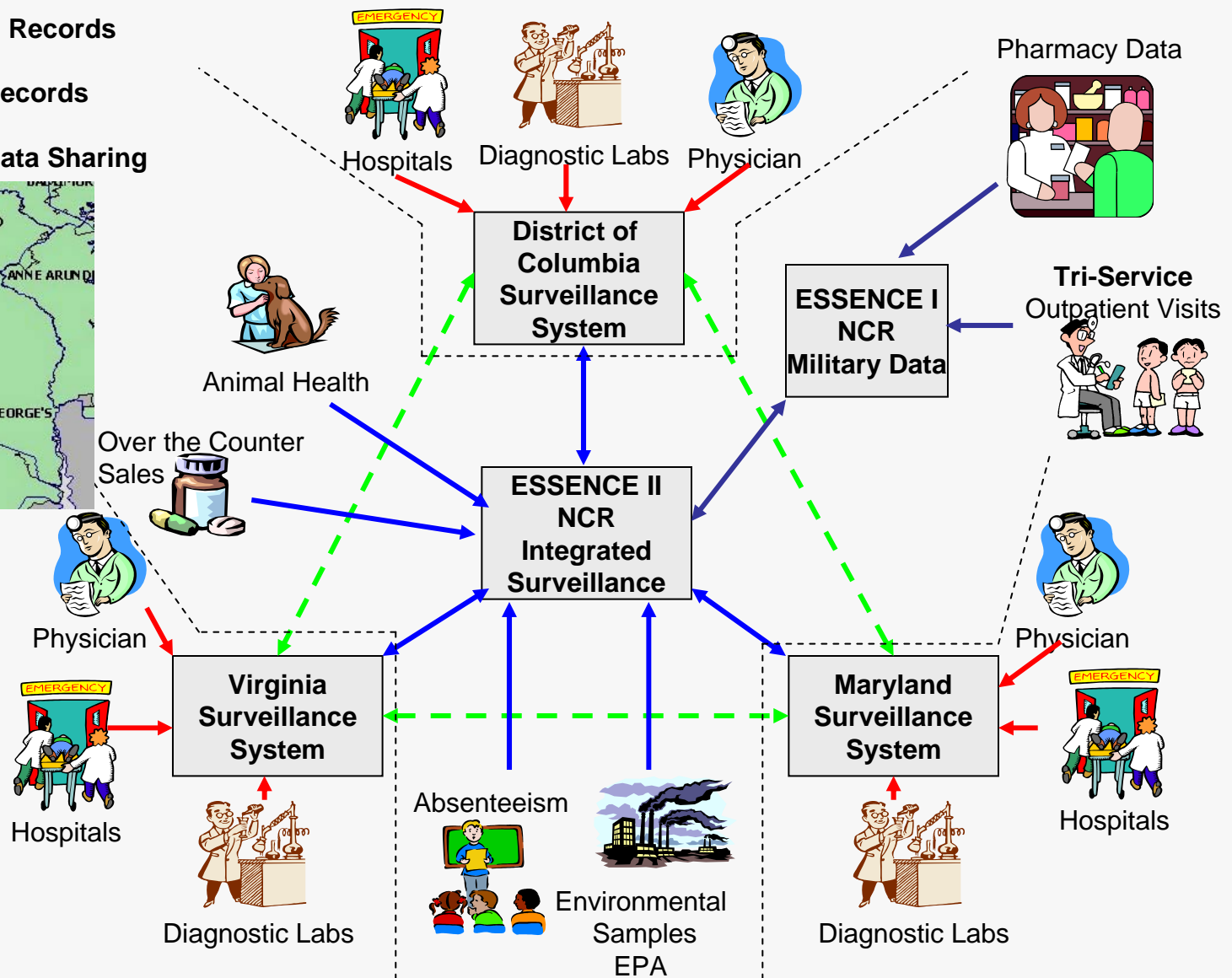
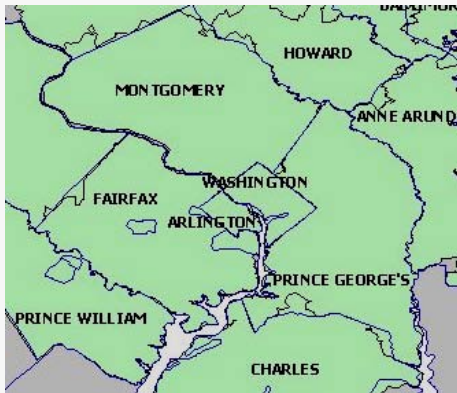






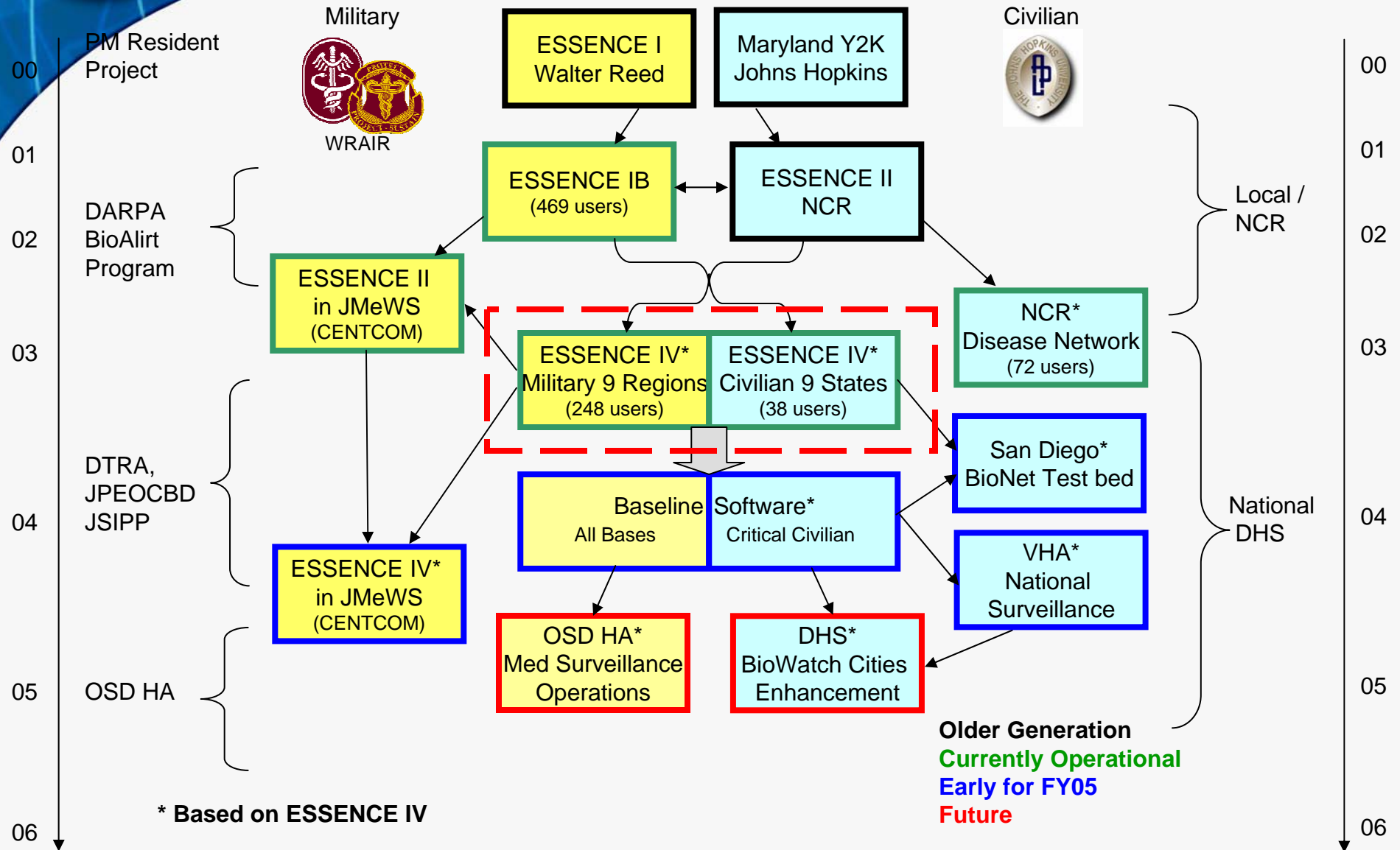
# NCR Disease Surveillance Network

- Fully Identified Records
- De-Identified Records
- De-Identified Data Sharing





# Evolution of ESSENCE



History of ESSENCE

Syndrome Definitions

Detector Algorithms

Data Dictionary

Help



HOME



Site  
Selection



Alert List



Query



ILI%



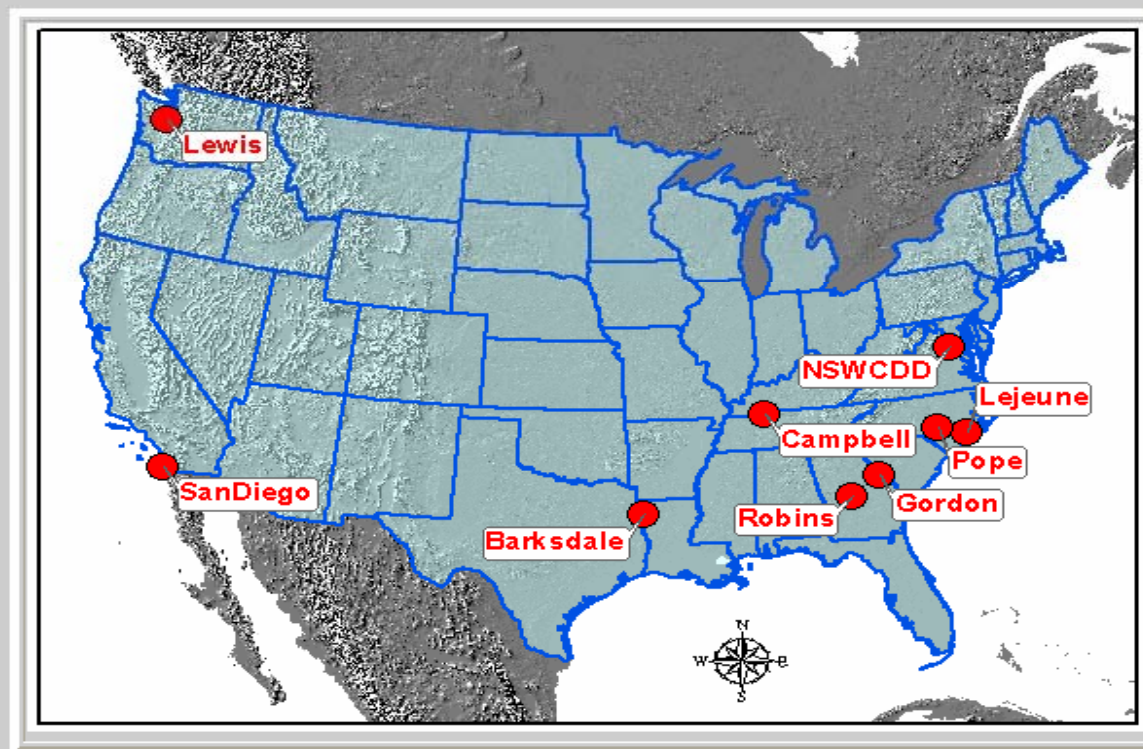
Map  
Portal



Message  
Board

## ESSENCE IV Site Selection

Select site

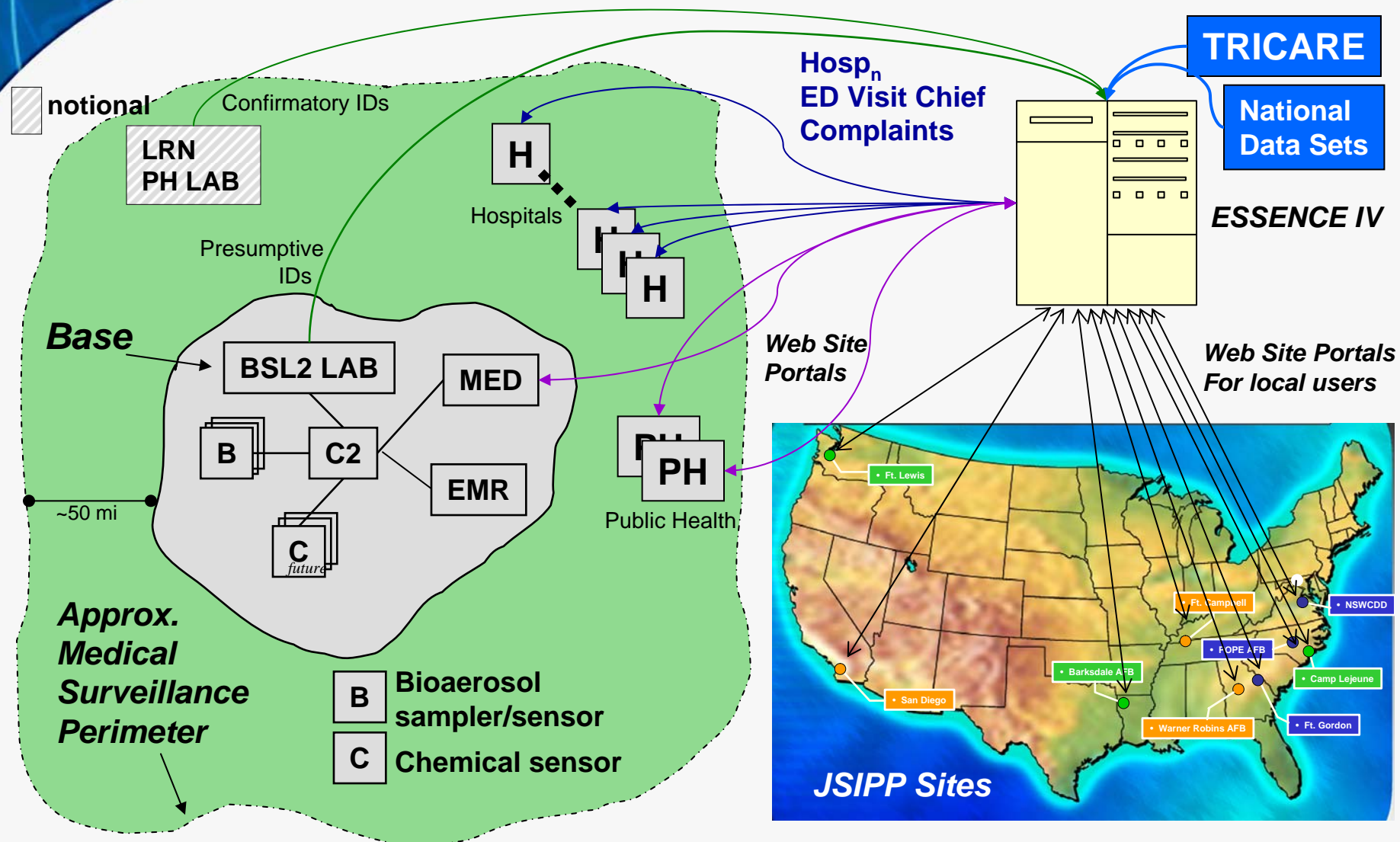


[Questions or Problems?](#)



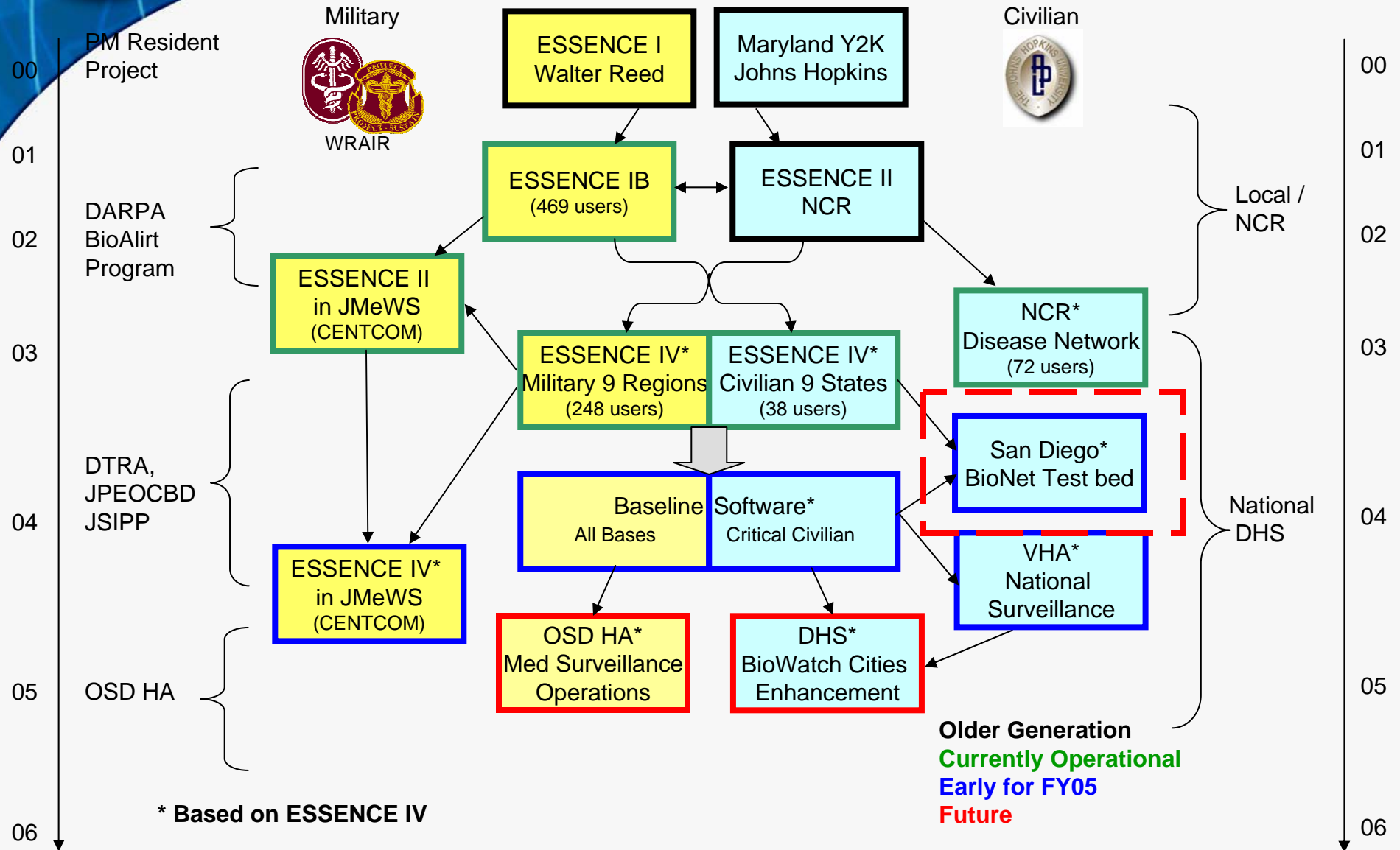


# Medical Surveillance Component of Installation Protection





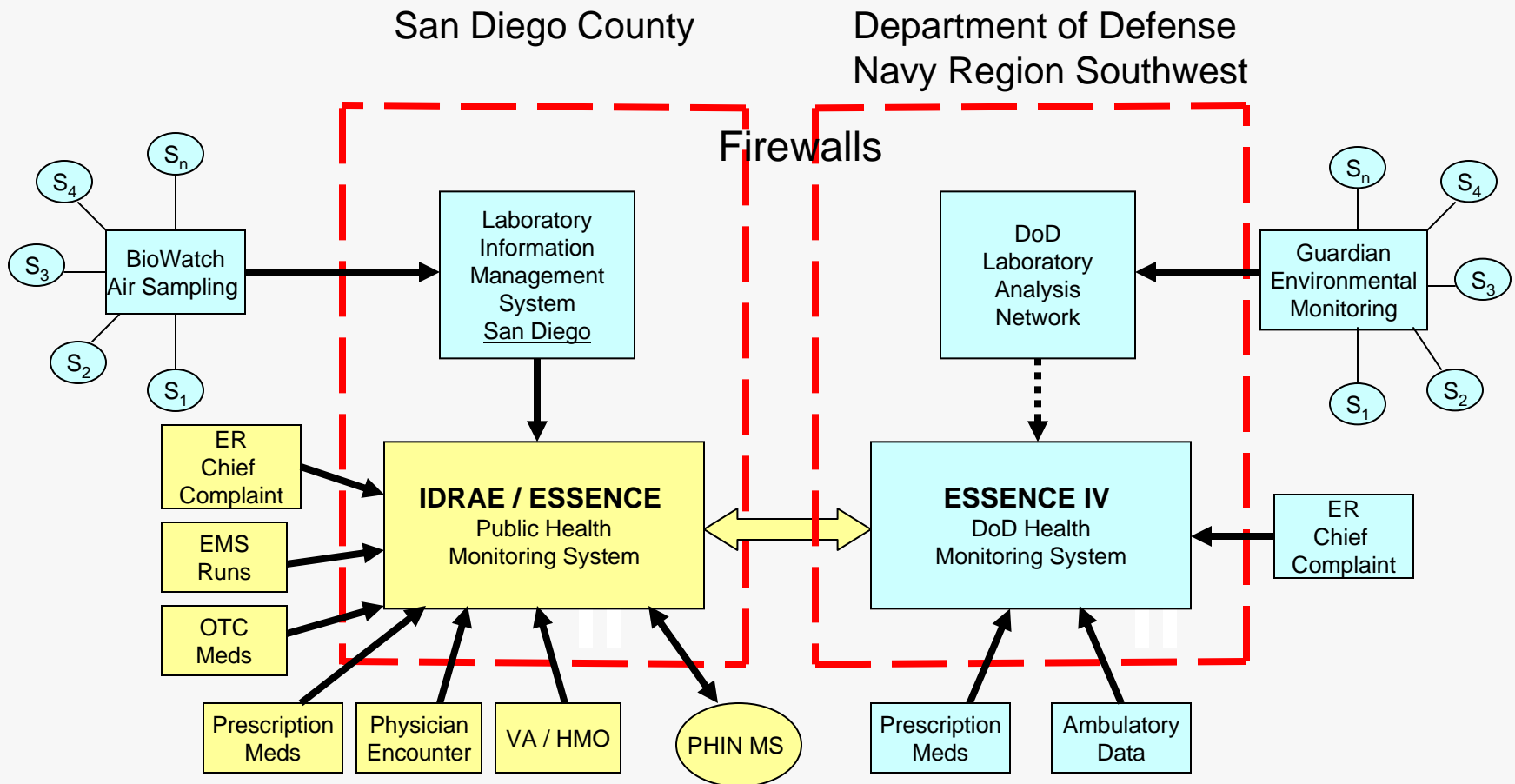
# Evolution of ESSENCE





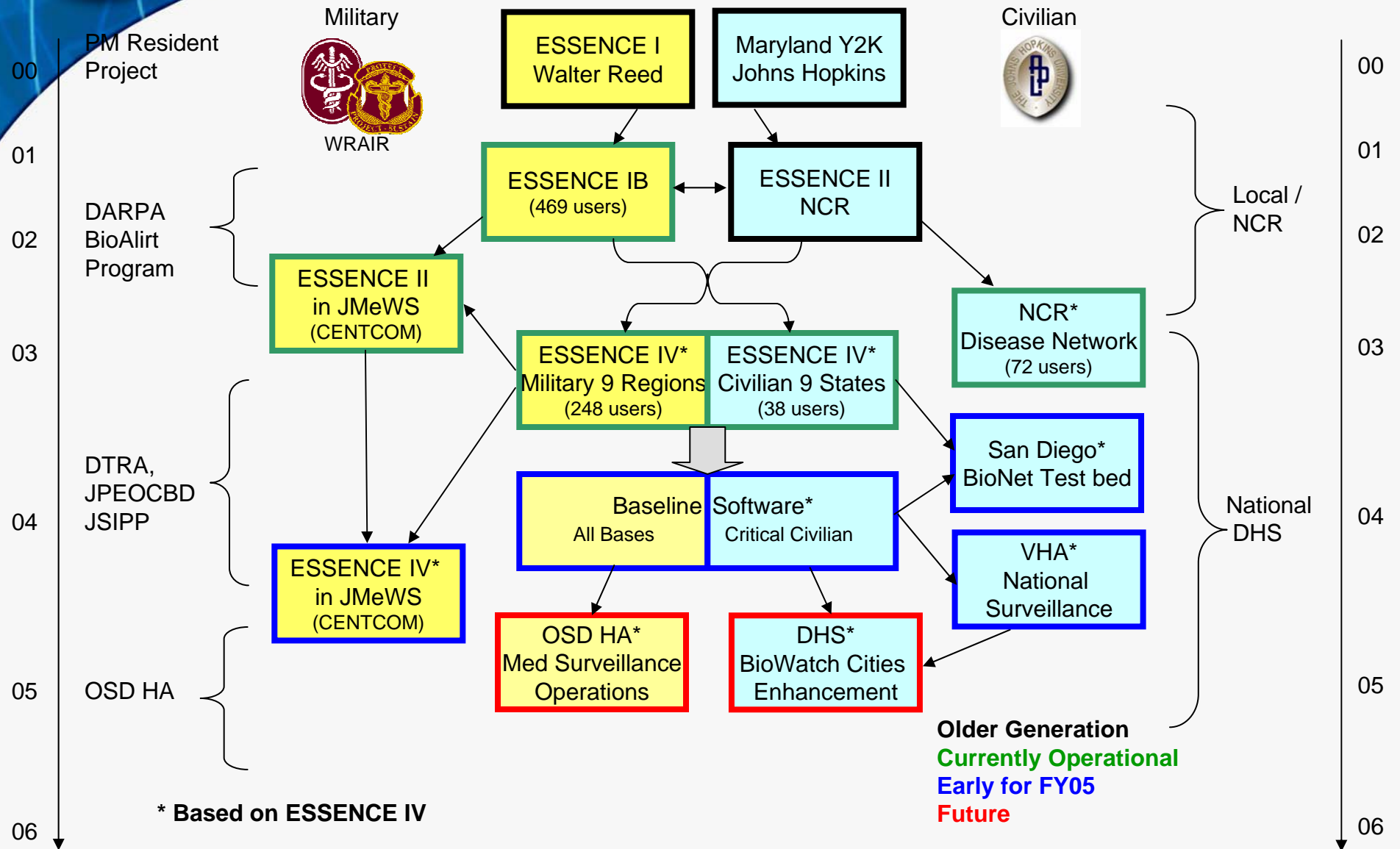


# Integration of Military and Civilian Medical Surveillance in San Diego County





# Evolution of ESSENCE





## Summary & Conclusions

- ESSENCE is the first system to integrate both military and civilian health indicator data for early notification of health events.
- ESSENCE versions are being used for public health surveillance of naturally occurring diseases as well as bioterrorist events.
- Public health surveillance has been around since the 14<sup>th</sup> century. Recent advances in information technology and outbreak detection algorithms have advanced disease surveillance to become an important factor in identification and management of major health events.